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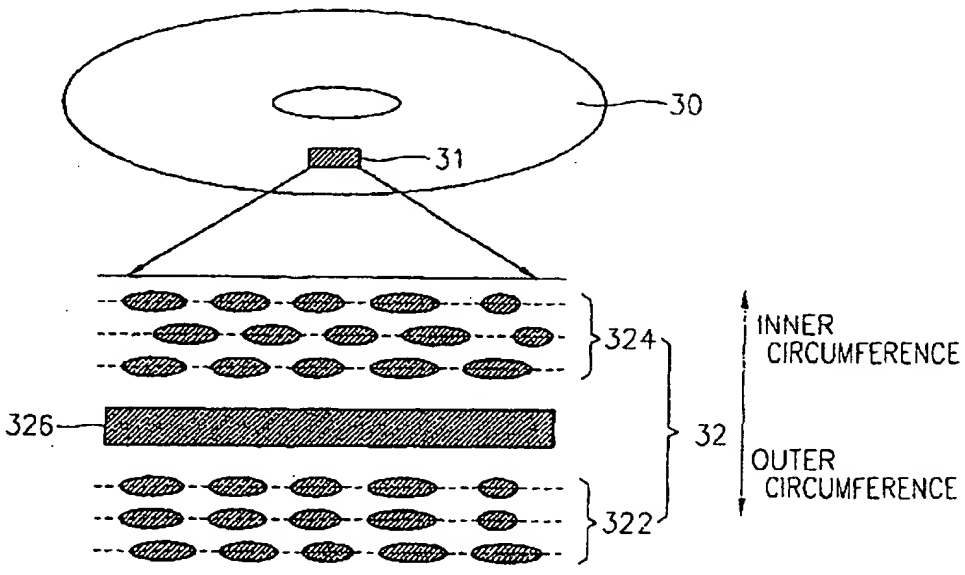
(54) Title: COPY PROTECTED OPTICAL DISC MANUFACTURING METHOD AND COPY PROTECTED OPTICAL DISC



(57) Abstract: A copy protected optical disc manufacturing method and a copy protected optical disc are provided. The method includes the step of inserting at least one predetermined optical head ditching (OHD) area, in which tracking of a light beam cannot be performed normally during a reproducing operation of an optical disc reproducing apparatus, between areas corresponding to contents. The copy protected optical disc cannot be copied using a recordable optical disc apparatus. Even if the copy protected optical disc is copied by an unknown method, a copy disc cannot be normally driven by an optical disc reproducing apparatus.

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COPY PROTECTED OPTICAL DISC MANUFACTURING METHOD AND COPY PROTECTED OPTICAL DISC

Technical Field

The present invention relates to a copy protected optical disc manufacturing method and a copy protected optical disc, and more particularly, to a method of manufacturing a copy protected optical disc having an optical head ditching (OHD) area which cannot be normally read by an optical disc reproducing apparatus in the case of illegal copy of the disc, and to the copy protected optical disc.

Background Art

Generally, a variety kinds of discs including optical discs are used for storing various types of information in various formats. Recently, as recordable optical discs such as CD-R, CD-RW, DVD-R, DVD-RW and DVD-RAM are commercially and widely spread, using of optical discs as personal auxiliary memory units has been increased. Moreover, as a demand for larger capacity of optical discs increases, and as related technology is developed, DVDs of large capacity are used widely.

In addition, an optical disc apparatus has usually been a read-only-type apparatus and served to widely spread contents of large capacity. Recently, as a recordable optical disc related apparatus is widely spread, an optical disc apparatus is being settled as an important personal auxiliary memory. However, as a recordable optical disc apparatus is widely used, a problem that the optical disc apparatus can be used for illegal copy occurs.

Copy using a recordable optical disc apparatus is fundamentally digital copy so that the signals of a copy disc is not degraded or deformed compared to the signals of an original disc. Accordingly, the contents or files of the copy disc have almost the same quality as those of the original disc so that contents developers and manufactures of original discs can

suffer serious damage.

Recently, since various kinds of hardware or software used for copy are rapidly developed, it is anticipated that illegal copy and distribution of optical discs brings serious economical and social problems. Therefore, proper technology of originally preventing illegal copy is desired.

A recordable area of a usual recordable optical disc can be sectioned into a plurality of sectors or blocks. Each sector is assigned a predetermined logical block address (LBA) regardless of recording or nonrecording of data. An optical disc apparatus for reading data recorded in an optical disc reads a logical address from the optical disc and irradiates a beam to the optical disc while running along a track on the optical disc, thereby reading the data from the optical disc. Here, the intensity of light reflected from a no pit area, in which no pits exist on a track of the optical disc, is large, but the intensity of light reflected from a pit on the track is low. An optical pickup converts the difference between the intensities of light reflected from the optical disc into an electrical digital signal and sequentially decodes the digital signal, thereby extracting meaningful information. The optical pickup irradiates an optical beam to a written pit and detects an optical beam reflected from the written pit. Here, the optical pickup not only detects and converts the difference between the intensities of light reflected from the optical disc into electrical digital data but also sends an electrical signal, which is obtained by detecting the difference between the intensities of reflected light, to a sled servo of the optical disc apparatus in order to control the speed of rotation of the optical disc.

Three essential conditions should be satisfied to enable data to be normally read from an optical disc. First, logical block address values, which are assigned to sectors in a recordable area in which data is recorded on an optical disc, should increase sequentially, and the size of a file calculated from the logical block address values should not larger than the size of a file supported by an operating system used in a computer

system operating in association with a reproducing apparatus. Second, the optical pickup of an optical disc reproducing apparatus should detect the center of a track which is composed of a series of written pits so that it can continuously run along the track. Third, for example, the servo signal of eight to fourteen modulation (EFM) data, which is read from pits written to a track, should be spent to a spindle servo of an optical disc driving device so that a spindle can be controlled normally. Optical disc apparatuses and optical discs are usually manufactured according to physical standards satisfying these conditions.

According to conventional copy protection technology, encryption of data is applied such that an encryption algorithm and an arbitrary error signal are embedded into an optical disc satisfying the above physical standards so as to be used as an identification (ID) signal. However, such copy protection technology has a drawback that a pre-mastering or mastering process is complex and a compatibility problem in that an original disc is not driven by a few driving devices. In addition, once the encryption algorithm is hacked or cracked, copy can be easily performed afterwards. Moreover, copy can easily performed when a tool of copying an original signal, that is, a signal including an error, is used.

Disclosure of the Invention

To solve the above problems, it is a first object of the present invention to provide a method of manufacturing a copy protected optical disc, through which computer software or digital contents recorded to the optical disc cannot be copied using recordable optical disc apparatuses such as CD-R, CD-RW, DVD-R, DVD-RW and DVD-RAM drives.

It is a second object of the present invention to provide a copy protected optical disc manufactured by the above method.

Accordingly, to achieve the first object, there is provided a method of manufacturing a copy protected optical disc, including the step of (a) inserting at least one predetermined optical head ditching (OHD) area, in

which tracking of a light beam cannot be performed normally during a reproducing operation of an optical disc reproducing apparatus, between areas corresponding to contents.

Preferably, the predetermined OHD area includes a series of pits, the difference between reflectances of light reflected from the pits being lower than a predetermined threshold value. Alternatively, the predetermined OHD area includes a no pit area in which no pits are formed. Preferably, the predetermined OHD area includes an OHD information data area to which a start address of a sector, which corresponds to another OHD area to be read next time, is recorded. Preferably, the predetermined OHD area includes an OHD information data area to which position information of a sector, in which effective data to be read next time is stored, is recorded. Preferably, the step (a) includes the steps of (a-1) performing formatting by inserting an OHD information layer, which includes position information of a sector corresponding to an OHD area to be read next time and position information of a sector in which effective data to be read next time is stored, and a production identifier for identifying a content, during a pre-mastering process; (a-2) making a stamper including at least one predetermined OHD area, in which tracking of a light beam cannot be performed normally during a reproducing operation of an optical disc reproducing apparatus, using a formatted signal during a mastering process; and (a-3) performing pressing using the stamper. Preferably, the step (a-1) includes the step of (a-1-1) scrambling logical block address information or OHD information indicating the position of a sector assigned to the OHD area.

To achieve the second object, there is provided a copy protected optical disc including at least one predetermined OHD area, in which tracking of a light beam cannot be performed normally during a reproducing operation of an optical disc reproducing apparatus, between areas corresponding to contents.

Brief Description of the Drawings

FIG. 1 is a flowchart of the main steps of a copy protected optical disc manufacturing method according to the present invention;

FIG. 2 is a diagram for explaining the structure of an optical head ditching (OHD) information data block;

FIG. 3 is a diagram of the structure of the inside of a copy protected optical disc according to the present invention;

FIG. 4 is a diagram of a file structure including an OHD area;

FIG. 5 is a diagram of a disc which includes the discontinuities of an address and on which scrambling has been performed; and

FIG. 6 is a flowchart of a method of identifying a copy protected disc of the present invention and a copy disc.

Best mode for carrying out the Invention

Hereinafter, embodiments of the present invention will be described with reference to the attached drawings.

FIG. 1 is a flowchart of the main steps of a method of manufacturing a copy protected optical disc according to an embodiment of the present invention. In this embodiment, a digital versatile disc (DVD) is used. Referring to FIG. 1, in step 102, during a pre-mastering process, formatting is performed such that an optical head ditching (OHD) information layer, which includes position information of a sector corresponding to an OHD area to be read next time and position information of a sector in which effective data to be read next time is stored, and a production identifier for identifying contents are inserted. Here, the contents may be image files, data files or program files. In addition, a driving program for performing control based on the position information of a sector corresponding to an OHD area to be read next time and position information of a sector in which effective data to be read next time is stored is dispersedly stored in the OHD information layer.

In step 104, during a mastering process, a stamper including at least

one predetermined OHD area, in which an optical disc reproducing apparatus cannot perform normal tracking of an optical beam during reproduction, is produced using the formatted signal. During this process, an OHD data block is generated, and an effective data block and the OHD data block including an OHD area are formed on a glass substrate by laser cutting. The stamper is produced using the mastering process. In step 106, pressing is performed using the stamper, and bonding is performed on a pressed disc, thereby manufacturing a copy protected optical disc.

Hereinafter, a procedure of manufacturing a copy protected disc by inserting OHD information into an original DVD file will be described in detail. For example, the original DVD file is composed of 10 blocks. In this embodiment, an OHD block of 10 blocks is inserted into the file every two blocks. The OHD block is composed of an OHD information data block of 3 blocks, a physical OHD block of 4 blocks and an OHD information data block of 3 blocks. The physical OHD block is embodied as a no pit area in which no pits are formed. Alternatively, the physical OHD block may include a series of pits which the difference between reflectances of light reflected from is lower than a predetermined threshold value at which tracking of a light beam is not normal.

FIG. 2 is a diagram for explaining the structure of an OHD information data block. The data structure of FIG. 2 corresponds to a single sector 22. 16 sectors construct a single OHD information data block. Referring to FIG. 2, OHD data includes a header field, an ID field 244, a current block indication field (Curr. Block Ind.) 246, an address information field (A. Info) 248, a next OHD layer start address 250, a next effective data start address 252 and a reserved field 254. Driving programs can be dispersedly stored in a data area 260 within the OHD information data block. In addition, an ID necessary for executing a driving program of an optical driving device can be inserted into the data area 260.

FIG. 3 illustrates an example of the structure of the inside of a copy protected optical disc according to the present invention. Referring to FIG.

3, a physical and artificial error structure is formed in a predetermined area 31 on a copy protected optical disc 30 according to the present invention. In other words, an OHD area 32 which is not normally accessed by a typical optical disc apparatus is formed. The OHD area 32 logically corresponds to an OHD block. Areas 322 and 324 correspond to OHD information data blocks, and an area 326 corresponds to a physical OHD block. In this example, the physical OHD block is embodied as a no pit area in which no pits are formed. Alternatively, the physical OHD block may be composed of a series of pits which the difference of reflectances of light reflected from is lower than a predetermined threshold value at which tracking of a light beam is not normal. The physical OHD block may be composed of series of pits having a length which does not satisfy the standards. An effective data area which can be normally accessed is formed next to the OHD area 32 which cannot be normally accessed. An OHD area and an effective data area are repeatedly and alternately formed. OHD information data corresponding to the areas 322 and 324 does not effective data, that is, contents, so that it can be referred to as dummy data. In other words, dummy data including address information of a sector from which data will be read next time is stored at the inner and outer circumferences of the physical OHD block corresponding to the area 326. Dummy data recorded to an optical disc has virtual volume. Accordingly, when an optical disc reproducing apparatus reads the volume of data from a copy disc of this copy protected optical disc, the operating system of a computer connected to the optical disc reproducing apparatus recognizes the volume of copied data as much larger than the actual volume of original data. For example, if the size of a file stored in a copy disc is recognized as 4 gigabytes, the file cannot be recognized by the operating system of a 32-bit based computer.

A file stored in an optical disc having such a physical structure has a structure as shown in FIG. 4. The structure of the file will be described on the assumption that data is sequentially read from the optical disc

starting from the inner circumference toward the outer circumference. As shown in FIG. 4, the file is composed of an OHD information (Info.) data field 402, an OHD field 404 and an OHD information data field 406 before an effective data field 408. After the effective data field 408, the file is also composed of an OHD information data field 410, an OHD field 412 and an OHD information data field 414 before an effective data field 416. Finally, after the effective data field 416, the file is composed of an OHD information data field 420, an OHD field 422 and an OHD information data field 424. Here, each of the OHD fields 404, 412 and 422 corresponds to a physical OHD block, that is, a block of data read from a no pit area in which no pits are formed.

Since such an optical disc includes a no pit area in which no pits are formed, normal tracking of a light beam cannot be performed by usual optical disc reproducing apparatuses. Accordingly, data cannot be normally read from the optical disc. However, it can be assumed that copy is attempted by reading data from an original disc while jumping the OHD area.

To prevent this attempt, an embodiment of the present invention scrambles a logical block address indicating the position of a sector assigned to an OHD area. When one or more OHD areas whose logical block addresses are scrambled are sequentially formed, logical block address values assigned to sectors within a data block on an optical disc do not sequentially increase. Such an optical disc according to the embodiment of the present invention has discontinuities in the logical block addresses of sectors, as shown in FIG. 5. As a result, when a copy protected optical disc manufactured by a method according to the present invention is read by a usual optical disc reproducing apparatus, the pickup of the optical disc reproducing apparatus, which cannot normally access an OHD area without sector address information, cannot normally read data from the original copy protected optical disc due to an OHD area making a sequence of addresses discontinuous. For example, when an optical disc

reproducing apparatus reads data from an optical disc, the optical disc reproducing apparatus expects sequential addresses for normal driving. Accordingly, when passing or tracking a discontinuous portion in a sequence of addresses, the driving device of the optical disc reproducing apparatus performs back track jump by a discontinuous offset to search for an address which is expected. However, the driving device continually meets OHD areas, i.e., discontinuous portions in a sequence of addresses and cannot detect the OHD areas. Consequently, data cannot be normally read from an original disc, thereby preventing copy. Even if an original disc is copied by a copy apparatus, addresses different from those on the original disc are recorded to a copy disc, so that the copy disc cannot be normally driven. In addition, after completing the tracking of a single OHD area, an address which is supposed to be normally assigned to the OHD area is recorded to the copy disc. This address is used for recording of succeeding effective data.

A no pit area included in an OHD area on a copy protected optical disc according to the embodiment of the present invention prevents a usual optical disc reproducing apparatus from deriving the position information of a track center. In other words, the optical disc reproducing apparatus cannot maintain normal servo tracking so that is it impossible to read data. In addition, since an eight to fourteen modulation (EFM) signal is not normally detected from the OHD area, the EFM signal is not provided to a spindle servo. Accordingly, a spindle servo motor is not normally controlled. Consequently, the reproducing apparatus stops tracking and reading of data so that normal reading of data cannot be achieved.

The following description concerns that a copy protected optical disc according to the present invention cannot be copied. Even if a single OHD area is copied by a recordable optical disc apparatus, the address of a following another OHD area appears after crossing a discontinuous portion occupying a good portion in a sequence of addresses. When this OHD area is completely copied, a discontinuous portion occupying a good

portion appears starting from a position where the OHD area ends, and then still another OHD area appears. When such a structure is repeated, it is difficult for an optical disc apparatus to read data from an original disc. In addition, even if data is read from the original disc and copied, an optical copy disc cannot have the same OHD structure and address structure as the original optical disc.

FIG. 6 is a flowchart of a method of identifying a copy protected optical disc of the present invention and a copy disc. Referring to FIG. 6, once a copy protected optical disc is inserted into an optical disc reproducing apparatus, in step 602, a driving program is read from the optical disc and automatically executed. The driving program may be loaded and executed by a control unit such as a microcomputer in the optical disc reproducing apparatus. Alternatively, the driving program may be executed by an operating system in a user computer connected to the optical disc reproducing apparatus. The driving program includes a routine of determining whether an OHD area is detected. Once the optical disc is driven, in step 604, a light beam is irradiated to the driven optical disc and data is read from the optical disc, so that it is determined whether an OHD area is detected from the optical disc. Alternatively, in step 604, it may be determined whether a sector has a predetermined structure based on the sector structure of an OHD area. If it is determined that an OHD area is detected, in step 606, an OHD data block is extracted. If the OHD data block is extracted, in step 608, an ID is extracted. The pattern of an error occurring due to a no pit area can be derived from the ID. Next, in step 610, it is determined whether the extracted ID is the same as that obtained from the driving program. If it is determined that the extracted ID is the same as that obtained from the driving program, in step 612, the optical disc is normally driven. Accordingly, even if a copy protected optical disc manufactured by a method according to the present invention is copied, an optical disc reproducing apparatus stops the normal driving of an optical copy disc at an initial stage so that the copy disc can be identified at the

initial stage. Therefore, a user's useless efforts or waste of time can be prevented.

Alternatively, an authentication key type routine of receiving, for example, a temporary service key from a remote server through Internet so as to allow an optical disc to be normally driven can be inserted into a driving program stored in the optical disc. In this case, in step 614, the user computer accesses the remote server and requests an authenticated service key. In step 616, it is determined whether the service key is received. If it is determined that the service key is received, the disc can be normally driven. However, if the OHD area is not detected in step 604, if the OHD data block is not extracted in step 606, or if the authenticated service key is not received in step 616, the driving program processes the operation as impossible driving in step 618. Addition of a routine of receiving a temporary service key from a server can prevent a case in which even if having an original optical disc, a client cannot use it because an ID is not normally generated in a computer. More specifically, once the driving program is executed, an access code is generated in a state in which a user is not aware of it. The generated access code is provided to the user through the Internet. Then, the user should input the same ID as a generated ID into a computer in order to use a pertinent optical disc. With such an arrangement, a single optical disc can be completely normally used by a single client.

As described above, when a usual optical disc reproducing apparatus reads an optical disc manufactured by a copy protected optical disc manufacturing method according to the present invention, the original optical disc can be discriminated from a copy disc by referring to detection/non-detection of information contained in an OHD area, which is determined through a driving program separately stored in the optical disc, so that a copy disc cannot be driven.

In addition, when an original disc according to the present invention is driven, a password, ID access address and the like necessary for an

optical disc driving device to execute the driving program are extracted based on information stored in an OHD information data block. The original disc can be normally driven, or it can be determined that the original disc cannot be driven. Accordingly, although logical block addresses assigned to sectors on an optical disc manufactured by a copy protected optical disc manufacturing method according to the present invention are discontinuously arranged, contents data can be normally reproduced from the optical disc. Therefore, a copy protected optical disc can be normally driven without adding additional hardware to an apparatus such as an optical disc driving device.

The driving program may be programmed such that a different access code is generated whenever the driving program is executed. In other words, some kinds of information are extracted from internal information which can be read from a personal computer, the extracted information is combined with error data read from a specific OHD area. The combined data can be used as an access code. In this case, only when OHD area information is exactly positioned at an OHD area on an original optical disc, a normal access code is generated so that the driving program is continuously and normally executed. Consequently, copy protection can be more reliably accomplished.

Selectively, some essential data of contents supposed to be read from an optical disc according to the present invention can be embedded in an OHD area. When some of the contents is embedded in an OHD area, or when OHD area information is embedded in a main program, it can be effectively prevented that a program hacked using an algorithm which does not refer to an OHD area is executed.

Moreover, since the predetermined volume of data stored in an OHD area can be dispersed and embedded throughout the entire contents of a file at predetermined intervals, the configuration of copy protection data can be changed depending on the content recorded to an optical disc so that the result of encryption can be changed. Accordingly, the present invention

can individually provide a copy protection service to copy right holders of the contents recorded to an optical disc.

As described above, it is impossible to copy an optical disc manufactured by a copy protected optical disc manufacturing method according to the present invention. Even if a copy protected optical disc according to the present invention is copied by an unknown method, a copy disc cannot be normally driven by an optical disc reproducing apparatus. Moreover, in a method of manufacturing a copy protected optical disc according to the present invention, the copy protected optical disc is made by embedding OHD data in a specific area on an optical disc, so that every process for copy protection is completed during pre-mastering and mastering processes in manufacturing an optical disc. Therefore, additional modifications to an existing optical disc reproducing apparatus is not necessary. In addition, by combining the copy protection structure of an optical disc in hardware with encryption and authentication technology in software, the reliability of copy protection can be increased.

Industrial Applicability

According to the present invention, a method of manufacturing a copy protected optical disc and the copy protected optical disc are provided so that an original optical disc cannot be copied using a recordable optical disc and a drive. Even if an original optical disc is copied by an unknown method, a copy disc cannot be normally driven by an optical disc reproducing apparatus.

What is claimed is:

1. A method of manufacturing a copy protected optical disc, comprising the step of (a) inserting at least one predetermined optical head ditching (OHD) area, in which tracking of a light beam cannot be performed normally during a reproducing operation of an optical disc reproducing apparatus, between areas corresponding to contents.

2. The method of claim 1, wherein the predetermined OHD area comprises a series of pits, the difference between reflectances of light reflected from the pits being lower than a predetermined threshold value.

3. The method of claim 1, wherein the predetermined OHD area comprises a no pit area in which no pits are formed.

4. The method of claim 1, wherein the predetermined OHD area comprises an OHD information data area to which a start address of a sector, which corresponds to another OHD area to be read next time, is recorded.

5. The method of claim 1, wherein the predetermined OHD area comprises an OHD information data area to which position information of a sector, in which effective data to be read next time is stored, is recorded.

6. The method of claim 1, wherein the step (a) comprises the steps of:

(a-1) performing authoring and formatting by inserting an OHD information layer which comprises position information of a sector corresponding to an OHD area to be read next time and position information of a sector in which effective data to be read next time is stored, a driving program which is dispersedly stored in the OHD information layer, and a production identifier for identifying a content during a pre-mastering

process;

(a-2) making a stamper comprising at least one predetermined OHD area, in which tracking of a light beam cannot be performed normally during a reproducing operation of an optical disc reproducing apparatus, using a formatted signal during a mastering process; and

(a-3) performing pressing using the stamper.

7. The method of claim 6, wherein the step (a-1) comprises the step of (a-1-1) scrambling logical block address information or OHD information indicating the position of a sector assigned to the OHD area.

8. A copy protected optical disc comprising at least one predetermined optical head ditching (OHD) area, in which tracking of a light beam cannot be performed normally during a reproducing operation of an optical disc reproducing apparatus, between areas corresponding to contents.

9. The copy protected optical disc of claim 8, wherein the predetermined OHD area comprises a series of pits, the difference between reflectances of light reflected from the pits being lower than a predetermined threshold value.

10. The copy protected optical disc of claim 8, wherein the predetermined OHD area comprises a no pit area in which no pits are formed.

11. The copy protected optical disc of claim 8, wherein the predetermined OHD area comprises an OHD information data area to which a start address of a sector, which corresponds to another OHD area to be read following a current sector, is recorded.

12. The copy protected optical disc of claim 8, wherein the predetermined OHD area comprises an OHD information data area to which position information of a sector, in which effective data to be read following a current sector is stored, is recorded.

13. The copy protected optical disc of claim 8, wherein a driving program is stored in the predetermined OHD area, the driving program performing control based on position information of a sector corresponding to an OHD area to be read next time and position information of a sector in which effective data to be read next time.

14. The copy protected optical disc of claim 8, wherein logical block address information or OHD information indicating the position of a sector assigned to the OHD area is scrambled.

FIG. 1

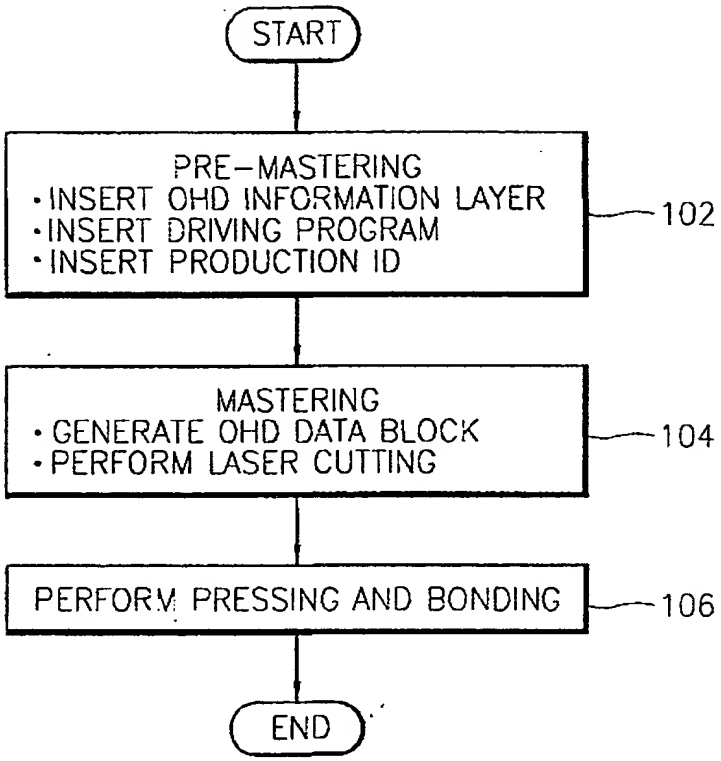

START
PRE-MASTERING
• INSERT OHD INFORMATION LAYER
• INSERT DRIVING PROGRAM
• INSERT PRODUCTION ID
102
MASTERING
• GENERATE OHD DATA BLOCK
• PERFORM LASER CUTTING
104
PERFORM PRESSING AND BONDING
106
END

FIG. 2

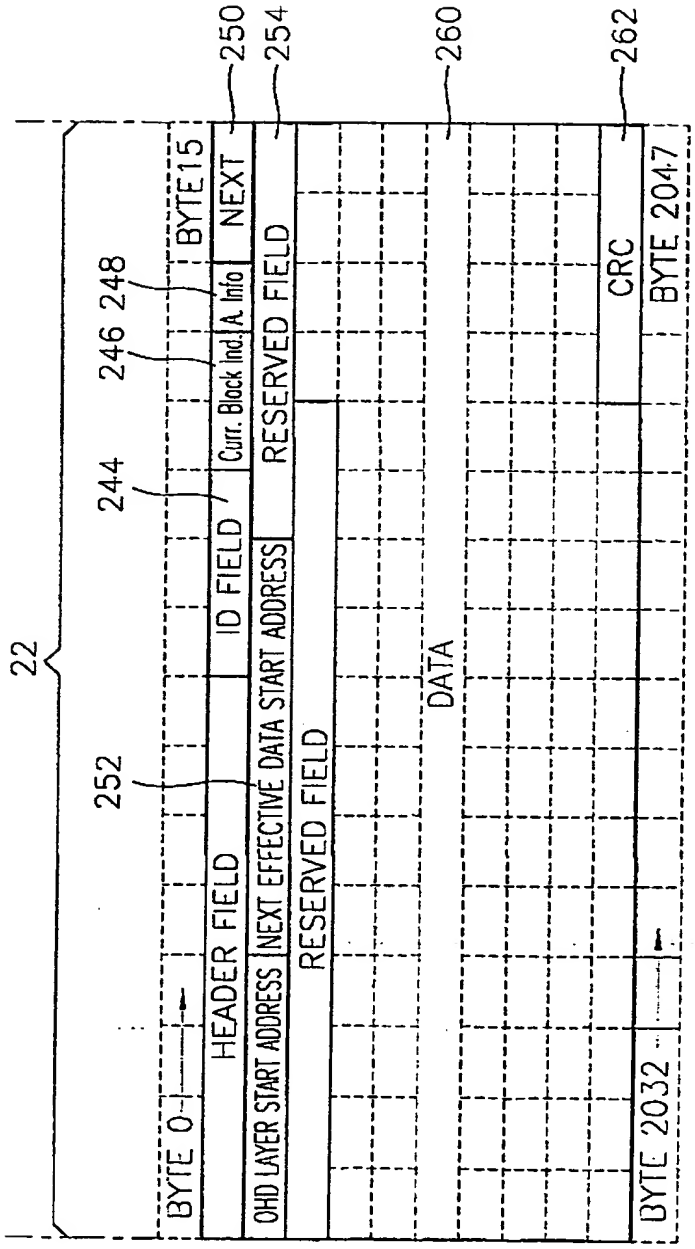

22
252
244
246
248
250
254
260
262
BYTE 0
BYTE15
HEADER FIELD
ID FIELD
Curr. Block Ind.
A Info
NEXT
OHD LAYER START ADDRESS
NEXT EFFECTIVE DATA START ADDRESS
RESERVED FIELD
RESERVED FIELD
DATA
CRC
BYTE 2032
BYTE 2047

FIG. 2

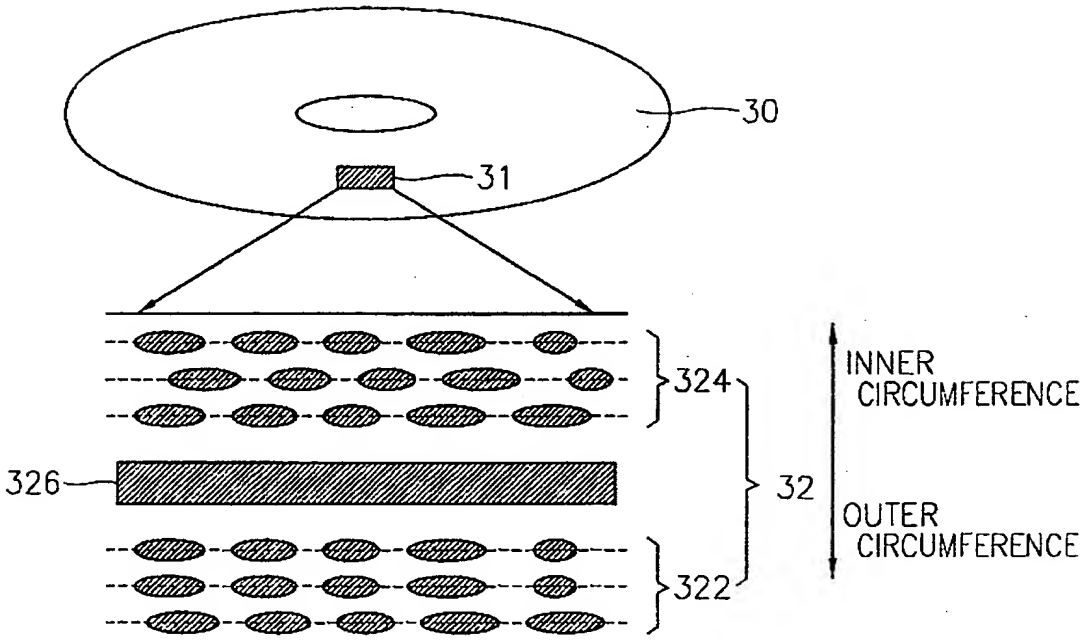

30
31
324
326
32
322
INNER CIRCUMFERENCE
OUTER CIRCUMFERENCE

FIG. 4

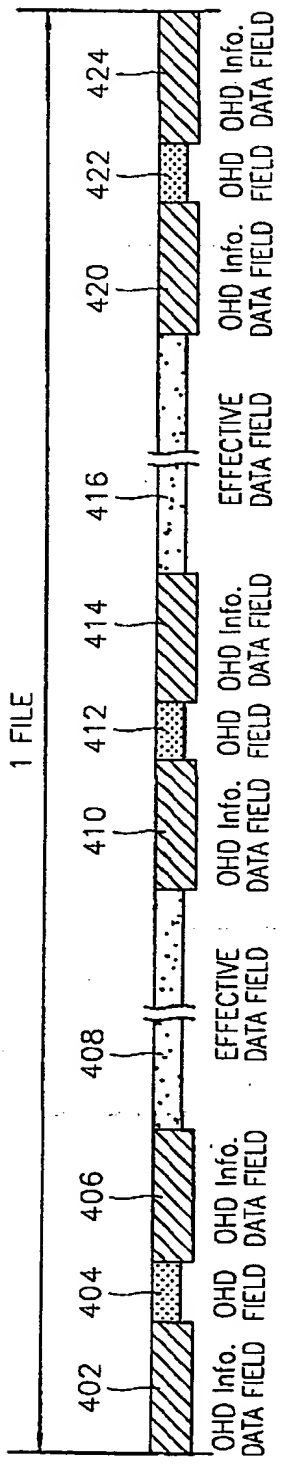

1 FILE
402
404
406
408
410
412
414
416
420
422
424
OHD Info. DATA FIELD
OHD FIELD
OHD Info. DATA FIELD
EFFECTIVE DATA FIELD
OHD Info. DATA FIELD
OHD FIELD
OHD Info. DATA FIELD
EFFECTIVE DATA FIELD
OHD Info. DATA FIELD
OHD FIELD
OHD Info. DATA FIELD

FIG. 5

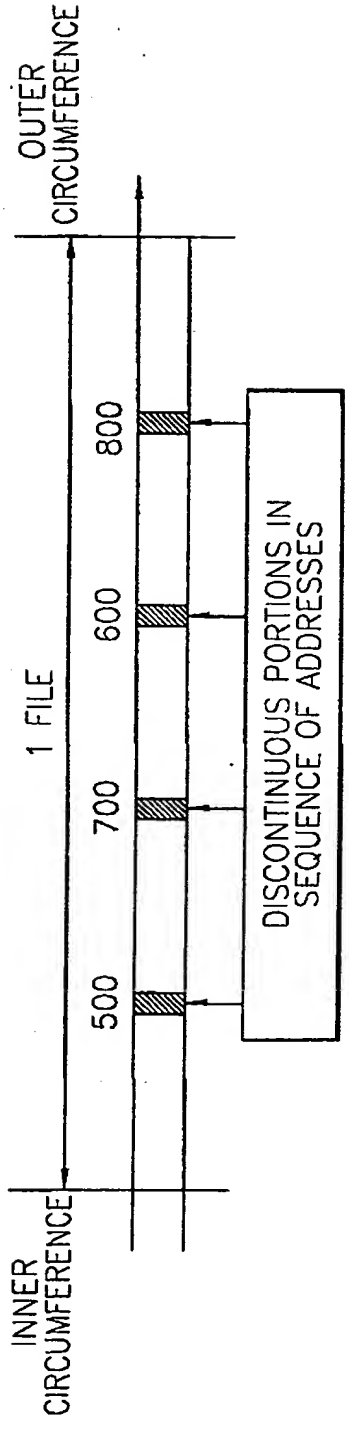
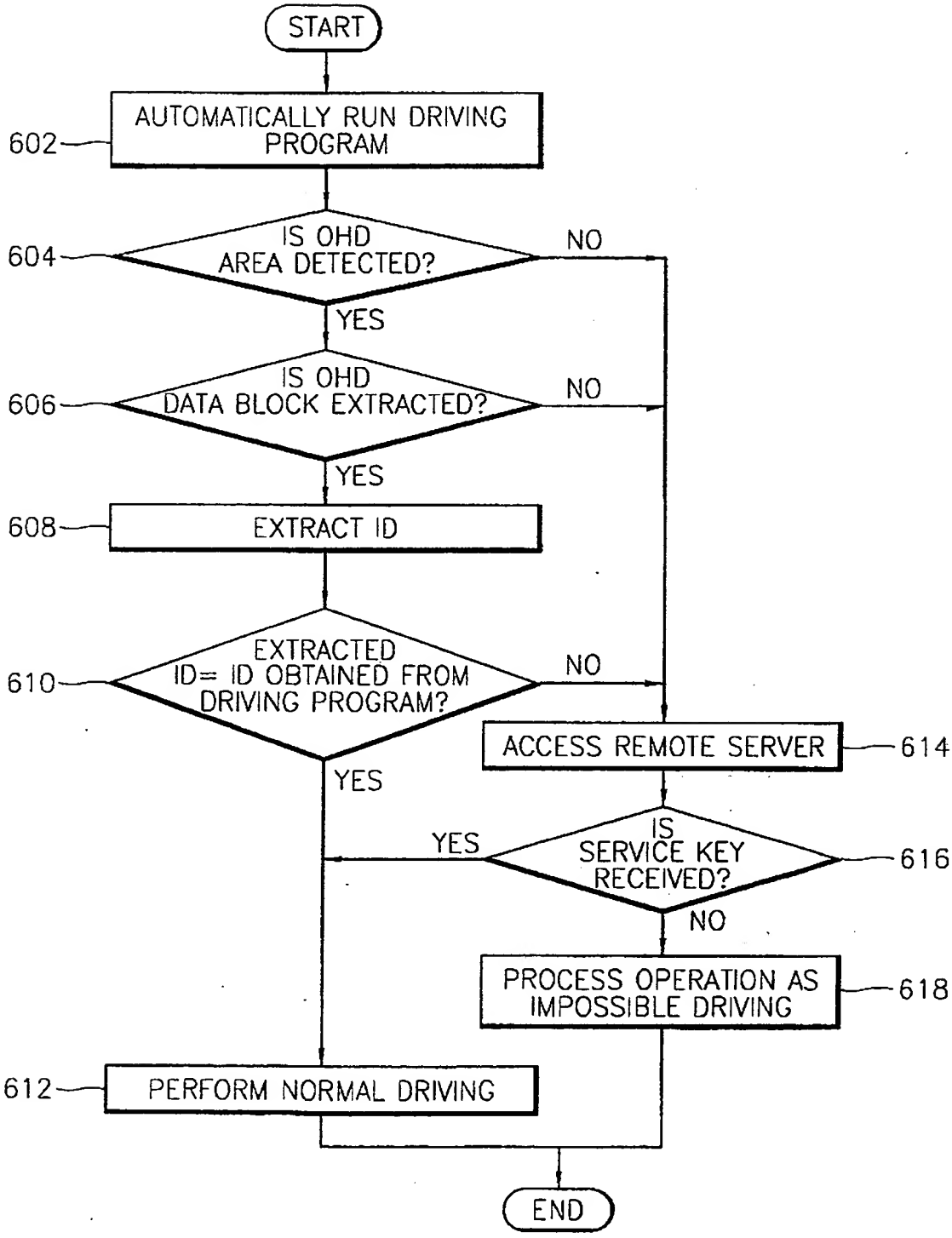

OUTER CIRCUMFERENCE
1 FILE
500
700
600
800
INNER CIRCUMFERENCE
DISCONTINUOUS PORTIONS IN SEQUENCE OF ADDRESSES

FIG. 6


START
AUTOMATICALLY RUN DRIVING PROGRAM
602
IS OHD AREA DETECTED?
604
NO
YES
IS OHD DATA BLOCK EXTRACTED?
606
NO
YES
EXTRACT ID
608
EXTRACTED ID= ID OBTAINED FROM DRIVING PROGRAM?
610
NO
YES
ACCESS REMOTE SERVER
614
IS SERVICE KEY RECEIVED?
616
YES
NO
PROCESS OPERATION AS IMPOSSIBLE DRIVING
618
PERFORM NORMAL DRIVING
612
END

INTERNATION. SEARCH REPORT

International application No.
PCT/KR01/00502

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 G11B 20/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)
IPC7 G11B20/12 G11B7/00 G11B7/24 G11B20/04

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched
Korean Patent Applications for Inventions since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search trerms used)
WPI, PAJ "DISC""COPY""PROTECT""ILLEGAL""PITS"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,572,507 (Victor Co.) 5 NOVEMBER 1996 see the whole document	1, 8
Y	US 5,805,551 (Matsushita Co.) 8 SEPTEMBER 1998 see the whole document	1, 8
A	US 5,570,339 (Victor Co.) 29 OCTOBER 199 6see the whole document	1, 8
A	US 5,8009,006 (Cagent Tec Inc.) 15 SEPTEMBER 1998 see the whole document	1, 8
A	US 6,108,296 (Sanyo Co.) 22 AUGUST 2000 see the whole document	1, 8

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevence
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
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"Y" document of particular relevence; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 OCTOBER 2001 (31.10.2001)	31 OCTOBER 2001 (31.10.2001)

Name and mailing address of the ISA/KR	Authorized officer
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